

SHAN LIN

Assistant Professor, School of Electrical, Computer and Energy Engineering

Arizona State University, Tempe, AZ, USA

 [Personal Website](#)

 [Google Scholar](#)

 shan.lin.2@asu.edu

RESEARCH INTERESTS

My research interests lie in the integration of artificial intelligence, robotic perception, motion planning, control, and manipulation, with a primary focus on addressing challenges in unstructured, dynamic, and deformable environments to create lifesaving robotic technologies for healthcare applications.

Research Themes

- Autonomous Robotic Surgery
- Computer- and Robot-Assisted Surgery
- Artificial Intelligence
- Robotic Perception
- Surgical Scene Reconstruction and Tracking
- Medical Image Analysis
- Robotic Manipulation

EDUCATION

Ph.D. in Electrical Engineering

Advisor: [Blake Hannaford](#)

University of Washington, Seattle, WA, USA

2017 – 2021

- Dissertation: Vision-based Surgical Instrument Segmentation and Endoscopic Sinus Surgery Skill Assessment.

M.S. in Electrical Engineering

Advisor: [Robert J. Webster III](#)

Vanderbilt University, Nashville, TN, USA

2015 – 2017

- Thesis: Monitoring of Thermal Processes for Medical Applications Using Infrared Thermography.

B.E. in Electronic and Information Engineering

Xiamen University, Xiamen, China

2011 – 2015

- Thesis: The Analysis of Semiconductor Laser Self-mixing Interference Technology and Its Applications.

PROFESSIONAL POSITIONS

Arizona State University

Tempe, AZ, USA

- Assistant Professor, Tenure-Track, School of Electrical, Computer and Energy Engineering

2025 –

University of California, San Diego

- Postdoctoral Fellow, Electrical and Computer Engineering

La Jolla, CA, USA

2021 – 2024

University of Washington

- Research Associate, [UW BioRobotics Lab](#)

Seattle, WA, USA

2017 – 2021

Harvard Medical School

- Research Intern, [Center for Advanced Medical Computing and Analysis](#)

Boston, MA, USA

2020

Vanderbilt University

- Research Assistant, [Medical Engineering and Discovery Lab](#)

Nashville, TN, USA

2016 – 2017

AWARDS

- Best Student Paper Award, [International Symposium on Medical Robotics \(ISMR\) 2024](#).
- [Pioneers of Medical Robotics Award](#), Data vs. Model in Medical Robotics Workshop at International Conference on Intelligent Robots and Systems (IROS) 2023. Award description: An award as part of the workshop to select two stellar doctoral/post-doctoral candidates in the field of medical robotics.
- [Rising Star in EECS](#), Oct. 2022. Description: As part of the international workshop for doctoral/post-doctoral candidates with historically underrepresented genders who are interested in pursuing academic careers.

PUBLICATIONS

* Equal contribution

JOURNALS**J7.** 3D Rendering of Cystoscopy Video Footage: A Novel Method Utilizing Neural Radiance Field ProcessingJ.E. Katz, J. Finegan, P.F. Beutelspacher, J. Lu, **S. Lin**, M. Yip, R.L. SurCureus, 17(8), 2025 [[paper](#)]**J6.** Efficient Data-Driven Joint-Level Calibration of Cable-Driven Surgical RobotsH. Peng, A. Lewis, Y.H. Su, **S. Lin**, D.T. Chiang, W. Jiang, H. Lai, B. Hannaford*npj Robotics*, 2(1), 1-16, 2024 [[paper](#)]**J5.** Reducing Annotating Load: Active Learning with Synthetic Images in Surgical Instrument SegmentationH. Peng, **S. Lin**, D. King, Y.H. Su, R.A. Bly, K.S. Moe, and B. Hannaford*Medical Image Analysis*, 97, p.103246, 2024 [[paper](#)]**J4.** ORRN: An ODE-based Recursive Registration Network for Deformable Respiratory Motion Estimation With Lung 4DCT ImagesX. Liang, **S. Lin**, F. Liu, D. Schreiber, and M.C. Yip

IEEE Transactions on Biomedical Engineering, pp. 1-12, 2023 [[paper](#)][[github](#)]

J3. Contour Primitive of Interest Extraction Network Based on Dual-Metric One-Shot Learning for Vision Measurement

F. Qin, **S. Lin**, and D. Xu

IEEE Transactions on Industrial Informatics, 19(4), pp.5839-5848, 2022 [[paper](#)]

J2. Multi-frame Feature Aggregation for Real-time Instrument Segmentation in Endoscopic Video

S. Lin, F. Qin, H. Peng, R.A. Bly, K.S. Moe, and B. Hannaford

IEEE Robotics and Automation Letters, 6(4), pp.6773-6780, 2021 [[paper](#)]

J1. Towards Better Surgical Instrument Segmentation in Endoscopic Vision: Multi-angle Feature Aggregation and Contour Supervision

F. Qin, **S. Lin**, Y. Li, R.A. Bly, K.S. Moe, and B. Hannaford

IEEE Robotics and Automation Letters, 5(4), pp.6639-6646, 2020 [[paper](#)]

CONFERENCES

C14. CtRNet-X: Camera-to-Robot Pose Estimation in Real-World Conditions Using a Single Camera

J. Lu, Z. Liang, T. Xie, F. Richter, **S. Lin**, S. Liu, M.C. Yip

IEEE International Conference on Robotics and Automation (ICRA), 2025 [[paper](#)]

C13. BASED: Bundle-Adjusting Surgical Endoscopic Dynamic Video Reconstruction using Neural Radiance Fields

S. Saha, Z. Liang, **S. Lin**, J. Lu, M.C. Yip, and S. Liu

IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), 2025 [[paper](#)]

C12. SuPerPM: A Surgical Perception Framework Based on Deep Point Matching Learned from Physical Constrained Simulation Data

S. Lin, A.J. Miao, A. Alabiad, F. Liu, K. Wang, J. Lu, F. Richter, and M.C. Yip

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2024 [[paper](#)]

C11. Coauthor of DROID: A Large-Scale In-The-Wild Robot Manipulation Dataset

Robotics: Science and Systems (RSS), 2024 [[paper](#)][[website](#)]

C10. HemoSet: The First Blood Segmentation Dataset for Automation of Hemostasis Management

A.J. Miao, **S. Lin**, J. Lu, F. Richter, B. Ostrander, E. Funk, R. Orosco, and M.C. Yip

International Symposium on Medical Robotics (ISMR), 2024 [[paper](#)]

Best Student Paper Award

C9. Tracking Snake-like Robots in the Wild Using Only a Single Camera

J. Lu, F. Richter, **S. Lin**, and M.C. Yip

IEEE International Conference on Robotics and Automation (ICRA), 2024 [[paper](#)]

- C8.** Real-to-Sim Deformable Object Manipulation: Optimizing Physics Models with Residual Mappings for Robotic Surgery
X. Liang, F. Liu, Y. Zhang, Y. Li, **S. Lin**, and M.C. Yip
IEEE International Conference on Robotics and Automation (ICRA), 2024 [[paper](#)]
- C7.** AnyOKP: One-Shot and Instance-Aware Object Keypoint Extraction with Pretrained ViT
F. Qin, T. Hou, **S. Lin**, Kaiyuan Wang, Michael C. Yip, and Shan Yu
IEEE International Conference on Robotics and Automation (ICRA), 2024 [[paper](#)][[github](#)]
- C6.** Coauthor of Open X-Embodiment: Robotic Learning Datasets and RT-X Models
IEEE International Conference on Robotics and Automation (ICRA), 2024 [[paper](#)][[website](#)]
Best Conference Paper Award
- C5.** Semantic-SuPer: A Semantic-aware Surgical Perception Framework for Endoscopic Tissue Identification, Reconstruction, and Tracking
S. Lin, A.J. Miao, J. Lu, S. Yu, Z.Y. Chiu, F. Richter, and M.C. Yip
IEEE International Conference on Robotics and Automation (ICRA), pp. 4739-4746, 2023 [[paper](#)][[github](#)]
- C4.** Endoscope Localization and Dense Surgical Scene Reconstruction for Stereo Endoscopy by Unsupervised Optical Flow and Kanade-Lucas-Tomasi Tracking
Z. Yang, **S. Lin**, R. Simon, and C.A. Linte
Annual International Conference of the IEEE Engineering in Medicine & Biology Society, pp. 4839-4842, 2022 [[paper](#)][[github](#)]
- C3.** LC-GAN: Image-to-Image Translation Based on Generative Adversarial Network for Endoscopic Images
S. Lin, F. Qin, Y. Li, R.A. Bly, K.S. Moe, and B. Hannaford
International Conference on Intelligent Robots and Systems (IROS), pp. 2914-2920, 2020 [[paper](#)]
- C2.** Video-based Automatic and Objective Endoscopic Sinus Surgery Skill Assessment
S. Lin, X. Gu, R.A. Bly, K.S. Moe, and B. Hannaford
SPIE Medical Imaging 2020: Image-Guided Procedures, Robotic Interventions, and Modeling, Vol. 11315, pp. 663-670, 2020 [[paper](#)]
- C1.** Don't Get Burned: Thermal Monitoring of Vessel Sealing Using a Miniature Infrared Camera
S. Lin, L. Fichera, M.J. Fulton, and R.J. Webster III
SPIE Medical Imaging 2017: Image-Guided Procedures, Robotic Interventions, and Modeling, Vol. 10135, pp. 263-269, 2017 [[paper](#)]

PRE-PRINTS

- P1.** SurgXBench: Explainable Vision-Language Model Benchmark for Surgery
J. Cheng, X. Zhao, S. Liu, X. Yu, R. Prakash, P. J. Codd, J. E. Katz, **S. Lin**
arXiv preprint, 2025 [[paper](#)]

P2. TwinTrack: Bridging Vision and Contact Physics for Real-Time Tracking of Unknown Dynamic Objects

W. Yang, Zhixian Xie, Xuechao Zhang, Heni Ben Amor, Shan Lin, Wanxin Jin
arXiv preprint, 2025 [[paper](#)]

WORKSHOPS**W3. BAA-NGP: Bundle-Adjusting Accelerated Neural Graphics Primitives**

S. Liu^{*}, **S. Lin^{*}**, J. Lu, A. Supikov, and M.C. Yip

Workshop on Visual Odometry and Computer Vision Applications Based on Location Clues at CVPR, 2024
[[paper](#)][[github](#)]

W2. Semantic-SuPer: Employing Semantic Perception for Endoscopic Tissue Identification, Reconstruction, and Tracking

S. Lin, J. Lu, F. Richter, and M.C. Yip

Workshop on Integrated Perception, Planning, and Control for Physically and Contextually-Aware Robot Autonomy at IROS, 2023 [[paper](#)]

W1. Automatic Sinus Surgery Skill Assessment Based on Instrument Segmentation and Tracking in Endoscopic Video

S. Lin, F. Qin, R.A. Bly, K.S. Moe, and B. Hannaford

Multiscale Multimodal Medical Imaging at MICCAI, pp. 93-100, 2019 [[paper](#)]

THESES**T2. Vision-based Surgical Instrument Segmentation and Endoscopic Sinus Surgery Skill Assessment**

S. Lin, Ph.D. Dissertation, University of Washington, 2021 [[paper](#)]

T1. Monitoring of Thermal Processes for Medical Applications Using Infrared Thermography

S. Lin, M.S. Thesis, Vanderbilt University, 2017 [[paper](#)]

INVITED TALKS

• **IEEE International Conference on Robotics and Automation 2025 1st International Workshop on the Evolving Landscape of Surgical Robotics.** Intelligent, Multimodal Surgical Perception. 05/19/2025, Atlanta, USA.

• **Southwest Robotics Symposium.** ASU Faculty Talks. 10/31/2024, Tempe, USA.

• **International Symposium for Medical Robotics 2024 Workshop on Machine Learning with the da Vinci Research Kit.** Bringing Deep Learning to Surgical Scene Reconstruction and Tracking. 06/03/2024, Atlanta, USA.

• **Arizona State University.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 03/20/2024, Phoenix, USA.

• **Duke University.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 03/11/2024, Durham, USA.

- **Worcester Polytechnic Institute.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 02/23/2024, Worcester, USA.
- **University of Rochester.** Robust Surgical Perception: Toward Autonomous Robotic Surgery. 02/09/2024, Rochester, USA.
- **International Conference on Intelligent Robots and Systems 2023 Workshop on Data vs. Model in Medical Robotics.** Employing Robust, Semantic Perception for Endoscopic Tissue Identification, Tracking, and Reconstruction. 10/05/2023, Detroit, USA.
- **Worcester Polytechnic Institute Robotics Colloquium.** Exploring Robust Real-time Instrument Segmentation for Endoscopic Sinus Surgery. 09/10/2021, virtual.
- **University of California San Diego.** Exploring More Generalizable and Robust Instrument Segmentation for Endoscopic Sinus Surgery. 05/07/2021, virtual.
- **Mount Holyoke College CS Seminar.** Exploring Robust Real-time Instrument Segmentation for Endoscopic Sinus Surgery. 03/05/2020, virtual.
- **Johns Hopkins University LCSR Seminar.** Exploring Robust Real-time Instrument Segmentation for Endoscopic Sinus Surgery. 02/10/2020, virtual.

NEWS COVERAGE

- **ASU Full Circle.** *New Faculty Member, 2024–25*. Oct, 2024.
- **Computer Vision News.** *Pioneers of Medical Robotics from Data vs Model in Medical Robotics Workshop – IROS 2023*. Oct, 2023.

PROFESSIONAL SERVICES

Workshop / Symposium Organizer:

- 1st International Workshop on the Evolving Landscape of Surgical Robotics (ELSR), ICRA 2025, Atlanta, USA
- Southwest Robotics Symposium 2024, Arizona State University

Reviewer:

- Robotics: Science and Systems (RSS)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Soft Robotics (RoboSoft)
- International Symposium on Medical Robotics (ISMR)
- IEEE Robotics and Automation Letters (RA-L)
- IEEE Transactions on Medical Imaging (TMI)

- International Journal of Robotics Research (IJRR)
- Journal of Medical Robotics Research (JMRR)
- IEEE Transactions on Medical Robotics and Bionics (T-MRB)

MENTORSHIP

PhD Student

Arizona State University

- Jiajun Cheng 2025
Benchmarking and Developing Vision Language Models for Surgical Data
- Haokai Xu 2025
Dynamic and Deformable Scene 3D Reconstruction
- Hiu Ching (Athena) Cheung - Joining in Spring 2026 2026
Physics-based Deformable Object Manipulation

Master's Student

Arizona State University

- Xianwu Zhao 2025
Benchmarking Vision Language Models for Surgical Data

Undergraduate Student Mentorship

Arizona State University

- Spencer Romero 2025
Multimodal Sensing
- Leonardo Dayal 2025
Robot Pose Estimation

Past Mentorship During My Postdoc and PhD:

Master's Student

University of California San Diego

- Pradhit Ongole 2024
Deformable Object Manipulation
- Tung-Yen Chiang 2024
Lithotripsy Video Event Detection
- Zekai (Lucas) Liang, Now Ph.D. student at UC San Diego, USA 2024
Surgical Applications of INR, Robot Pose Tracking
- Sharvari Deshmukh 2024
Lithotripsy Video Event Detection
- Kaiyuan Wang, Now Ph.D. Student at USC, USA 2023-2024
Uncertainty Analysis of 3D Surgical Perception
- Saksham Jindal 2023
Robotics applications of INR
- Stephen Jarrell, Now Machine Learning Engineer at Google 2023

Surgical Applications of INR

- Rohitkumar Murali Arasanipalai 2022
Differentiable Rendering of Surgical Scenes
- Chong He, Now Ph.D. Student at Simon Fraser University, Canada 2021-2022
Surgical Video Event Detection
- Xiao Liang, Now Ph.D. student at UC San Diego, USA 2021-2022
4D-CT Lung Motion Tracking

Undergraduate Student

University of California San Diego

- Yijie He 2024
Lithotripsy Video Event Detection
 - Charvi Shukla 2024
LLMs for Medical Treatment Planning
 - Vandita Jain 2024
Physical Simulation-Assisted 3D Surgical Perception
 - Albert Miao, Now Ph.D. Student at University of Cambridge, UK 2021-2023
Semantic Information-Assisted 3D Surgical Perception
 - Ali Alabiad 2023
Physical Simulation-Assisted 3D Surgical Perception
 - Huaner Wang 2023
Vision-based Surgical Instrument Tracking
 - Shunkai Yu, Now Software Engineer at Qualcomm 2021-2022
Semantic Segmentation of Endoscopic Videos
- University of Washington
- Xinyu Gu 2020
Surgical Skill Assessment

TEACHING**Arizona State University, Tempe, USA**

School of Electrical, Computer and Energy Engineering

- EEE 203 Signals and Systems 01/2025 – 05/2025

Past Teaching During My PhD**University of Washington, Seattle, USA**

Course Developer and Instructor

Electrical & Computer Engineering Department

- EE 200A ECE Lecture Series on Image Processing

06/2020 – 08/2020

Course Developer

Global Innovation Exchange

- Robotics I: Navigation and Mobility

12/2019 – 03/2020

Teaching Assistant

Electrical & Computer Engineering Department

- EE 557 Dynamics of Controlled Systems *09/2019 – 12/2019*
- EE 447 Control System Analysis *09/2018 – 12/2018, 03/2019 – 06/2019, 03/2020 – 06/2020*
- EE 341 Discrete Time Linear Systems *01/2018 – 03/2018, 06/2018 – 08/2018, 01/2019 – 03/2019*
- EE 235 Continuous Time Linear Systems *09/2020 – 12/2020*
- EE 233 Circuit Theory *06/2019 – 08/2019*
- EE 215 Fundamentals of Electrical Engineering *03/2018 – 06/2018*

Vanderbilt University, Nashville, USA

Teaching Assistant

Computer Science Department

- CS2212 Discrete Structure *01/2017 – 04/2017*